Notice of Allowability	Application No.	Applicant(s)	
	10/689,106	LI ET AL.	
	Examiner	Art Unit	
	Aaron W. Carter	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the telephonic interview of 10/31/07 and amendments filed on 7/26/07*.

2. ☒ The allowed claim(s) is/are *1-14,16,18-31,33,37,39 and 40*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Brian G. Hart (Reg. No. 44,421) on October 31, 2007 and November 1, 2007.

The application has been amended as follows:

Claims 1-40 were originally pending. Please amend claims 11, 16, 18-27, 33 and 37. Kindly cancel claims 15, 17, 32, 34-36 and 38 without prejudice. No claims are added or withdrawn. Accordingly, claims 1-14, 16, 18-31, 33, 37, and 39-40 remain pending.
The following listing of claims replaces all prior versions and listings of claims in the application.

1. (Previously presented) A process implemented by a computing device for comparing two digital images, the process comprising:

comparing texture moment data for the two images to provide a first similarity index;

comparing color correlogram data for the two images to provide a second similarity index;

comparing color moment data for the two images to provide a third similarity index;

combining the first, second and third similarity indices to provide a similarity value;

determining that the two images match when the similarity value exceeds a first threshold value; and

responsive to determining that the two images match, providing an indication that the two images match.

2. (Original) The process of claim 1, wherein combining comprises forming a weighted sum from the first, second and third similarity indices.

3. (Original) The process of claim 1, further comprising determining that the two images do not match when the similarity value is less than a second threshold value.

4. (Original) The process of claim 1, wherein the two images comprise a first and a second image, the first of the two images comprises a query image, and further comprising locating one or more matches to a plurality of images in a database of images by iterating the acts of comparing color correlogram data, comparing color moment data, comparing texture moment data, combining and determining using as the second image a successive one image of the plurality of images.

5. (Original) The process of claim 1, further comprising:

comparing one or more high-level features from each of the two images; and

adjusting the similarity value in accordance with comparing one or more high-level features, prior to determining.

6. (Original) The process of claim 1, further comprising:

extracting one or more high-level features from each of the two images, wherein the one or more high-level features include a high-level feature chosen from a group consisting of: presence/absence of one or more human faces, indoor/outdoor scene and time/date of image formation;

comparing one or more of the high-level features from each of the two images; and

adjusting the similarity value in accordance with comparing one or more high-level features, prior to determining.

7. (Original) The process of claim 1, further comprising, after combining and before determining, adjusting the similarity value based on a calculation of commonality or lack of commonality between one or more high-level features associated with each of the two images and a confidence value thereof.

8. (Original) The process of claim 1, wherein at least one of the two images is a digital image taken using a digital camera.

9. (Original) The process of claim 1, wherein combining comprises:

weighting the first, second and third similarity indices by assigning the first similarity index a greatest weight and assigning the third similarity index a least weight; and

adding the weighted first, second and third similarity indices to provide an adjusted similarity value, wherein determining employs the adjusted similarity value in determining that the two images match.

10. (Original) The process of claim 1, further comprising quantizing the similarity value prior to determining, wherein quantizing comprises quantizing according to a tiered ranking scheme employing fewer than ten levels ranging from a lowest to a highest tier, with greater similarity values corresponding to higher tiers, wherein the first threshold value corresponds to a highest tier into which similarity values are quantized.

11. (Currently amended) A process implemented by a computing device for manipulating image characterization data from a digital image, the process comprising:

indexing the digital image by extracting low-level feature data corresponding to a plurality of low-level features from the digital image, the plurality comprising two or more low-level features chosen from a group ~~consisting of:~~ comprising texture moment data~~;~~, color correlogram data~~;~~, and color moment data;

organizing the data into a feature vector by;

(a) forming a query vector;

(b) if extracted low-level feature data corresponds to:

(i) texture moment data: comparing texture moment data for the query and feature vectors to provide a first similarity index;

(ii) color correlogram data: comparing color correlogram data for the query and feature vectors to provide a second similarity index; and

(iii) color moment data: comparing color moment data for the query and feature vectors to provide a third similarity index; and

(c) combining available ones of the first, second and third similarity indices to provide the feature vector;

utilizing the feature vector to identify a set of similar digital images; and

providing a result that identifies the set of similar images.

12. (Original) The process of claim 11, wherein indexing comprises:

first extracting texture moment data from the digital image;

second extracting color correlogram data from the digital image; and

third extracting color moment data from the digital image.

13. (Original) The process of claim 11, further comprising storing the feature vector in a database.

14. (Original) The process of claim 11, wherein organizing the data comprises forming a query vector, and further comprising:

obtaining a feature vector from a group of feature vectors corresponding to a plurality of digital images;

comparing the query vector to the feature vector to provide a similarity value;

determining when the similarity value exceeds a first threshold; and

iterating obtaining, comparing and determining for each feature vector of the group.

15. (Canceled)

16. (Currently amended) A ~~process~~ computer-readable storage medium having embedded there on computer-program instructions for comparing two digital images, the computer-program instructions, when executed by a processor, for performing operations comprising:

comparing texture moment data for the two images to provide a similarity index, the similarity index being a first similarity index;

comparing color correlogram data for the two images to provide a second similarity index;

comparing color moment data for the two images to provide a third similarity index;

combining the first similarity index with other data to provide a similarity value, the other data comprising the second and the third similarity indices;

determining a degree to which the two images match when the similarity value exceeds a first threshold value; and

responsive to determining the degree to which the two images match, providing a result that indicates whether the two images match.

17. (Canceled)

18. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, wherein combining comprises forming a weighted sum from the similarity index and other data.

19. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, further comprising determining that the two images do not match when the similarity value is less than a second threshold value.

20. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, wherein the two images comprise a first and a second image, the first of the two images comprises a query image, and further comprising locating one or more matches to a plurality of images in a database of images by iterating the acts of comparing, combining and determining using as the second image a successive one image taken from the plurality of images.

21. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, further comprising:

comparing one or more high-level features from each of the two images; and

adjusting the similarity value in accordance with comparing one or more high-level features, prior to determining.

22. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, further comprising:

extracting one or more high-level features from each of the two images, wherein the one or more high-level features include a high-level feature chosen from a group consisting of: presence/absence of one or more human faces, indoor/outdoor scene and time/date of image formation;

comparing one or more high-level features from each of the two images; and

adjusting the similarity value in accordance with comparing one or more high-level features, prior to determining.

23. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, further comprising, after combining and before determining, adjusting the similarity value based on a calculation of commonality or lack of commonality between one or more high-level features associated with each of the two images and a confidence value thereof.

24. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, wherein at least one of the two images is a digital image taken using a digital camera.

25. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, ~~wherein the similarity index is a first similarity index, and further comprising~~ wherein combining the first similarity index with the other data further comprises:

~~comparing color correlogram data for the two images to provide a second similarity index; and~~

~~comparing color moment data for the two images to provide a third similarity index;~~

~~wherein combining comprises:~~

weighting the first, second and third similarity indices by assigning the first similarity index a greatest weight and assigning the third similarity index a least weight; and

adding the weighted first, second and third similarity indices to provide an adjusted similarity value, wherein determining employs the adjusted similarity value in determining that the two images match when the similarity value exceeds the first threshold value.

26. (Currently amended) The ~~process~~ computer-readable storage medium of claim 16, further comprising quantizing the similarity value according to a tiered ranking scheme employing fewer than ten levels ranging from a lowest to a highest tier, with greater similarity values corresponding to higher tiers, wherein the first threshold value corresponds to a highest tier into which similarity values are quantized.

27. (Currently amended) A camera comprising:

an image capture device configured to capture digital images;

a memory coupled to the image capture device and configured to store a database of image data, including the digital images and associated feature vectors each comprising texture moment data, correlogram data and color moment data; and

an image similarity module coupled to the memory and configured to:

generate a query vector comprising texture moment data, correlogram data and color moment data;

compare, in succession, the query vector to each feature vector in the database, to generate a similarity value;

classify each feature vector to assign each feature vector to a tier in a tiered similarity structure based on the associated similarity value;

group images associated with the respective feature vectors in each tier of the similarity structure to generate group(s) of similar images; and

provide the group(s) of similar images for sorting.

28. (Original) The camera of claim 27, wherein the image similarity module is further configured to:

adjust each similarity value in conformance with comparison of high-level data corresponding to the query vector and high-level data corresponding to each feature vector to provide an adjusted similarity value corresponding to each feature vector; and

use the adjusted similarity value to classify each feature vector in the tiered similarity structure.

29. (Original) The camera of claim 27, wherein the image similarity module is further configured to adjust each similarity value in conformance with comparison of high-level data corresponding to the query vector and high-level data corresponding to each feature vector to provide an adjusted similarity value corresponding to each feature vector, wherein high-level

data comprises: presence/absence of one or more human faces; indoor/outdoor scene; and time of image formation.

30. (Original) The camera of claim 27, wherein the image similarity module is further configured to:

adjust each similarity value in conformance with comparison of high-level data corresponding to the query vector and high-level data corresponding to each feature vector to provide an adjusted similarity value corresponding to each feature vector, wherein high-level data comprises: presence/absence of one or more human faces, indoor/outdoor scene and time/date of image formation; and

use the adjusted similarity value to classify each feature vector in the tiered similarity structure.

31. (Original) The camera of claim 27, further comprising a monitor configured to facilitate viewing of digital images stored in the database, wherein the digital images are accessed via associated feature vectors selected within a tier of the tiered similarity structure.

32. (Canceled)

33. (Currently amended) A computer readable storage medium ~~on a tangible data storage device, the computer readable medium~~ having embedded thereon a plurality of computer-

program instructions, the computer-program instructions, ~~thereon that,~~ when executed by one or more processors, ~~cause the one or more processors to~~ for performing operations comprising:

successively ~~compare~~ comparing a query vector to each feature vector in a database, the query vector and the feature vectors each including texture moment data, correlogram data and color moment data;

successively compare texture moment data from the query vector to texture moment data from each feature vector to provide a first similarity index;

successively compare correlogram data from the query vector to correlogram data from each feature vector to provide a second similarity index;

successively compare color moment data from the query vector to color moment data from each feature vector to provide a third similarity index; and

form a similarity value as a weighted sum of the first, second and third similarity indices for each feature vector, wherein the plurality of instructions that cause the one or more processors to rank comprise instructions that cause the one or more processors to quantize similarity values into ranked tiers based in part on high-level features associated with the query vector and the feature vectors, each tier corresponding to a different degree of similarity between the query vector and the feature vectors associated with that tier;

~~rank~~ ranking each feature vector into a tier of a tiered classification scheme based on the comparison between the feature vector and the query vector; and

utilizing the tiered classification scheme to provide an indication whether first and second digital images have matching similarities.

34. (Canceled)

35. (Canceled)

36. (Canceled)

37. (Currently amended) A system for image correlation comprising:

one or more processors;

a memory coupled to the one or more processors, the memory comprising computer-program instructions executable by the one or more processors ~~and configured~~ to store a database representing digital images, the computer-program instructions comprising;

an image comparison module configured to

(a) cause the one or more processors to access the data representing the images and to select one or more feature vectors each associated with a corresponding image based on comparison of color texture data and other data contained in each feature vector with analogous data contained in a query feature vector; ~~and~~

(b) compare correlogram data and color moment data contained in each feature vector with analogous data contained in the query feature vector; and

(c) select the one or more feature vectors based on a weighted sum of similarity indices respectively derived from comparing the color texture moments, the correlogram data and the color moment data; and

a display device coupled to the one or more processors and to the memory and configured to display digital images corresponding to the selected one or more feature vectors in response to user input, the digital images having been determined to share a set of similarity characteristics.

38. (Canceled)

39. (Original) The system of claim 37, wherein the other data include high-level feature data.

40. (Original) The system of claim 37, wherein the image comparison module further is configured to cause the one or more processors to:

extract one or more high-level features contained in each feature vector and analogous data contained in the query feature vector, wherein the one or more high-level features include a high-level feature chosen from a group consisting of: presence/absence of one or more human faces; indoor/outdoor scene; and time of image formation;

compare one or more of the high-level features from each feature vector and analogous data contained in the query feature vector; and

employ results from comparing the one or more high-level features in selecting the one or more feature vectors.

41. (Canceled)

DETAILED ACTION

1. This action is responsive to the telephonic interview on 10/31/07 and papers filed on 7/26/07.

Response to Amendment

2. In response to applicant's amendment received on 7/26/07, all requested changes to the claims have been entered.

Allowable Subject Matter

3. Claims 1-14, 16, 18-31, 33, 37 and 39-40 are allowed.

The following is an examiner's statement of reasons for allowance:

4. As to claims 1, 11, 16, 27, 33 and 37, none of the prior art teach or fairly suggests using two or more of the comparing texture moment data of two images to generate a first similarity index, comparing color correlogram data of two images to generate a second similarity index, comparing color moment data of two images to generate a third similarity index, and combining the indices to provide a similarity value. The prior art of USPN 6,957,387 to Barbieri discloses comparing on color, texture, shape or motion of two images to determine a similarity and to determine if the two images match (column 6, lines 15-51), including the use of color correlogram data (column 11, lines 45-51), but does not teach or fairly suggest comparing the

images based on two or more of the image feature data and creating an combined similarity value for use in determining if they match. The prior art of US 2003/0093437 to Gargi et al. discloses determining a distance between two images based on several weighted features determined from each of the two images, the features including HSV histogram, color moment, color coherence, MRSAR texture, coarseness and directionality data (Tables 1-4). However, Gargi et al. does not teach or fairly suggest using the distance to determine a similarity value from which it is determined that the two images match. The prior art of the article titled "Benchmarking of Image Features for Content-based Retrieval" to Ma et al., already or record, discloses the advantages of using each of the features, including color moment data, color correlogram data and texture moment data, individually for image retrieval (sections 3.3 and 3.4), but does not teach or fairly suggest comparing the images based on two or more of the image feature data and creating an combined similarity value to determine if they match. In conclusion, none of the prior art teaches or fairly suggest using two or more of the comparing texture moment data of two images to generate a first similarity index, comparing color correlogram data of two images to generate a second similarity index, comparing color moment data of two images to generate a third similarity index, and combining the two or more generated indices to provide a similarity value, as disclosed in the limitations of claims 1, 11, 16, 27, 33 and 37.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

USPN 6,246,790 to Huang et al. discloses image indexing using color correlograms.

USPN 7,233,708 to Li et al. discloses image indexing and retrieval using texture moment data.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron W. Carter whose telephone number is (571) 272-7445. The examiner can normally be reached on 8am - 4:30 am (Mon. - Fri.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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